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THE INDICES OF REFRACTION OF MIXTURES.

By James S. Stevens.

Gladstone and Dale have shown (see Preston's *Light*) that the index of refraction varies with the density in such a manner that $\frac{\mu - 1}{\rho}$ = constant, where μ = the index of refraction and ρ the density. This has been applied to the determination of the refractive index of a mixture in the following manner:

Let v_1, ρ_1 and μ_1 = the volume, density and refractive index of the first liquid.

v_2, ρ_2 and μ_2 = the corresponding terms for the second liquid.

v, ρ and μ = the corresponding terms for the mixture.

μ^1_1 and μ^1_2 = the new indices of the components after the mixture has taken place.

ρ^1_1 and ρ^1_1 = the new densities of the components after the mixture has taken place.

Since mass equals volume times density, and the mass of the mixture equals the sum of the masses of the components, we have

$$\rho\, v = \rho_1\, v_1 + \rho_2\, v_2.$$

Since volumes are inversely as densities, and since each component occupies the volume v in the mixture, we may write

$$\frac{v_1}{v} = \frac{\rho^1_1}{\rho_1} \text{ and } \frac{v_2}{v} = \frac{\rho^1_2}{\rho_2}.$$

Now, by Gladstone's law,

$$\frac{\mu_1 - 1}{\rho_1} = \frac{\mu^1_1 - 1}{\rho_1} = \frac{\mu^1_1 - 1}{\rho_1} \cdot \frac{v}{v_1}.$$

and

$$\frac{\mu_2 - 1}{\rho_2} = \frac{\mu^1_2 - 1}{\rho^1_2} = \frac{\mu^1_2 - 1}{\rho_2} \cdot \frac{\nu}{\nu_2}.$$

Since $\mu - 1$ represents the excess of refraction due to the presence of molecules

$$(\mu - 1) = (\mu^1_1 - 1) + (\mu^1_2 - 1).$$

Substituting in this equation the values given in those above, we have

$$\mu - 1 = (\mu_1 - 1)\frac{v_1}{v} + (\mu_2 - 1)\frac{v_2}{v}.$$

If, now, we know the relative volumes of each component in the mixture, and the original refractive indices of the components, we may find that of the mixture.

The object of the following experiments was to test this law for mixtures of various oils with alcohol. The work was carefully performed by Miss Marie C. Rice, a student at the University. Unless otherwise specified, $v_1 = v_2$ or the volumes of the components were taken equal.

TABLE.

Liquid.	Refraction Index.	By Formula.
Alcohol	1.3615	—
Oil of cloves	1.5302	—
Mixture	1.4475	1.4464
Spearmint	1.4853	—
Mixture	1.4269	1.4233
Tansy	1.5016	—
Mixture	1.4795	1.4315
Lavender	1.4533	—
Mixture	1.4120	1.4073
Mixture 1:5	1.3789	1.3779
Oil of cloves and alcohol 1:4	1.3973	1.3926

These results would indicate that the law holds within the limits of error of measurement.

An interesting result was obtained with water and alcohol. Assuming that when equal volumes of these liquids are mixed together there is a contraction of about 3 per cent. (see "Encyc. Brit.," article "Alcohol"), we would have for the volume ratio

$$\frac{50}{97} = \frac{v_1}{v}.$$

Calling the index of refraction of water 1·3332 the experimental result obtained by the mixture was 1·3587. By the formula, without allowing for the contraction, 1·3474; allowing for the contraction, 1·3569, which is as close as the average results. This suggests a method by which the volume of a mixture of any liquids which contract when placed together, but do not act chemically upon each other, may be obtained.

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THE THERAPEUTIC APPLICATION OF THE X-RAYS.

BY M. I. WILBERT,
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The marvelous cures that are being reported in the daily press as having been accomplished by means of the X-rays would warrant the presentation of the true status of these rays as a therapeutic agent. The reports as published are rather misleading, in that they have a tendency to make people believe that treatment by means of the X-rays was not alone well established, but that in many if not all cases of pathological new growths or ulcerations this method of treatment would dispense entirely with the use of the surgeon's knife.

In this respect these reports are likely to cause a considerable amount of harm by inducing individuals to refuse to submit to a surgical operation at a time when such a procedure would involve little or no risk to life, but would, on the other hand, appear to offer some chance of bringing about a permanent cure.

The pharmacist can and should contribute his share to a proper elucidation of the facts. In matters of this kind he is often asked for

his opinion or advice by customers or friends, and if he, as he should be, is able to speak intelligently on the subject, he will probably have sufficient influence to induce the patient to submit to the advice or directions of his family physician. That the X-rays have effected cures that appear to border on the wonderful cannot be denied. But it is also true that the conditions under which these cures have been effected cannot readily be duplicated in every instance. We have here but another illustration of the fact, that while success in any field of human achievement is, as a rule, freely reported, corresponding failures also happen but are given little or no publicity, and usually find their way to our knowledge by disappointing personal experiences.

To get a better idea of the action of the X-rays it will be necessary to follow in outline the development of our knowledge of the subject.

As is well known, the announcement of the discovery of these physical phenomena was made by Wilhelm Conrad Roentgen, at Würzburg, during December, 1895, and by him named the X or unknown rays. These rays are caused by the discharge of a high tension current of electricity through a suitable vacuum tube, and may be defined as "a form of energy that will penetrate otherwise opaque bodies, and cause certain chemical substances to fluoresce, or they will affect photographic plates very much similar to ordinary actinic light." All of these properties had been observed by Roentgen before he announced his discovery, and practically the only new discovery that has been added is the fact that these rays are practically conductors of electricity, and have the additional property of dispersing negative charges on insulated surfaces, and then charging these same surfaces with a positive charge.

The fact that the X-rays had the property of penetrating otherwise opaque bodies was immediately made use of to a considerable extent, largely with a view of exploiting the possibilities of their application for scientific investigations. Shortly after the first announcement of the discovery of these rays, there appeared in the medical, as well as lay-press, accounts of peculiar secondary effects that were occasioned by a prolonged exposure to the excited vacuum tube. Chief among these was a severe dermatitis, or inflammation of the skin, simulating a very severe case of sunburn. In cases where the head and face had been exposed this was some-

times accompanied by a falling out of the hair of the head or beard. In some of the cases the inflammatory condition is said to have appeared on the side of the part that was farthest removed from the tube.

It was immediately suggested that here was a means by which disease in any portion of the body might be reached and modified. This suggestion led to extensive investigations, and it was soon found that the rays themselves had little or no effect on the growth of micro-organisms in suitable culture media. It was evident, then, that any healing properties that these rays possessed were not due to any direct bactericidal action, and must therefore be of some different nature.

The exact mode of action has even at the present time not been definitely determined; it is probably due to some electro-chemical action on the healthy cells or cell-contents, causing an active though non-infectious inflammatory condition that ultimately results in a marked improvement in the circulation and tone of the surrounding tissues.

Extensive experiments have been made in Europe, as well as in this country, and a considerable amount of reliable data has been collected as to the effects that the X-rays have on different conditions under varying circumstances.

So far, most promising and satisfactory results have been obtained in cases of superficial new growths, like the epidermoid cancers and epitheliomata. The rays have also been used, with some favorable results, in cases of carcinoma of the breast both new and recurrent. The most promising field, however, for the application of the X-rays appears to be in cases of lupus, a form of tuberculosis involving the skin. This is one of the diseases that does not readily yield to ordinary therapeutic measures, and the favorable and apparently permanent results that have been obtained by means of this new therapeutic agent are therefore particularly gratifying. Several series of experiments that have been made, and extensively quoted, appear to indicate that it is possible to modify the ordinary course of tubercular processes that have been artificially produced in guinea pigs. From these published reports we would be led to believe that here we have the promise of an active curative agent in the two scourges of the human family—carcinoma and consumption. It must be remembered, however, that a very great amount of experi-

mental work and honest scientific investigation must be done before it can be said definitely what can and what cannot be done by means of the X-rays. In the meantime we must not forget that these rays are active agents, and like all active agents for possible good, are also capable of doing harm in the hands of the inexperienced or careless.

It goes without saying that an agent that is powerful enough to effect a change in a chronic, abnormal condition that has refused to yield to other treatment, is also powerful enough to cause damage in normal structures when improperly used. In this connection it may be well to call attention to a paper published in a recent number of the *Philadelphia Medical Journal* by Dr. Codman, of Boston, in which he has collected data of upwards of 200 cases of so-called X-ray burns, and shows that a very large percentage of these cases were caused by either carelessness in the technic or by persons ignorant of the necessary precautions that should be taken.

In addition to the conditions that have been enumerated above, the X-rays have been used as a cosmetic agent to remove superfluous hair; in some cases of psoriasis, eczema and acne they have also given very favorable results. Altogether, it may be said that this mode of treatment is much more applicable in the various affections of the skin than in cases where the deeper tissues are involved, though a number of cases have been reported where enlarged glands have resolved themselves and disappeared without the use of any other therapeutic agent.

In addition to the curative action, the X-rays also have a marked analgesic or anodyne effect; this property has been noticed by many, and usually manifests itself in cases that have been exposed to the action of the X-rays for some time or repeatedly. By some, this anodyne effect of the X-rays is supposed to be purely mental; and while this may be true in some cases it does not explain why a patient is at times entirely relieved of pain for a considerable length of time after a prolonged exposure to these rays.

To sum up our present knowledge on the subject, we may say that, while a considerable amount of valuable data is available, there is no satisfactory basis on which we can estimate definitely the amount of exposure that will be required to bring about a certain curative effect. The factors entering into a computation of this

kind are so variable that, for the present at least, we have no definite or satisfactory clue or data for comparison.

What we can say definitely is, that a vacuum tube, working under favorable conditions, will penetrate a part of the human body and produce a demonstrable change in a photographic plate without any apparent change or effect in the part of the body that has been penetrated.

A longer exposure, however, appears to have a soothing or anodyne effect, even in cases where the patient appears to be suffering considerable pain.

A still longer exposure will, depending on the resistance of the individual and the length and condition of the exposure, produce a more or less decided local change in the cells of the part. This change may vary from the production of increased pigment, giving the surface a decidedly yellow or even brownish appearance through the various stages of dermatitis, or inflammation, simulating sunburn, to the production of a severe brushburn resulting in a deep slough or ulcer.

For therapeutic purposes this third stage can, by proper precautions, be kept under control, and in this way we are able to bring about changes that will result in the ultimate disappearance of some pathological conditions.

It must be remembered, however, that the number of factors that necessarily enter into the use of the X-rays as a therapeutic agent; the variability of the source of the energy, and the marked difference in the resisting powers of the individual, allow of such a wide variation in the ultimate results, that the use or suggestion of this means of treatment should be left entirely with the medical profession.

The medical journals are giving considerable space to the liberal discussion of the possibilities of this new therapeutic agent, so that there is no excuse for the modern physician not being thoroughly acquainted with all the advances as made. It will be quite safe, therefore, for the pharmacist to advise his customers and friends to abide by the decision and advice of their family physician, even in case this does not agree with the reputed advances in medicine as heralded in the daily papers.

THE COLOR-COMPOUND OF STYLOPHORUM DIPHYLLUM AND CHELIDONIUM MAJUS.

By J. O. Schlotterbeck.

The two plants, Stylophorum diphyllum and Chelidonium majus, Family Papaveraceæ, are so closely related botanically that a cursory glance would scarcely distinguishes them. In fact, they are properly species of the same genus. A remarkable similarity in chemical constituents is also evident, since both plants contain the alkaloids chelidonine, protopine and sanguinarine, yellow coloring matter of an alkaloidal nature and chelidonic acid. The yellow coloring matter was first found in Chelidonium by Probst and given the descriptive name chelidoxanthin. In a paper[1] entitled, "Contribution to the Chemistry of Stylophorum Diphyllum," the statement was made that a yellow color body was separated which from analogy was believed to be identical with the chelidoxanthin of Probst. The properties of chelidoxanthin are described by Probst as follows: "Short, yellow needles, very difficultly soluble in cold water, more easily soluble in hot water, more soluble in dilute alcohol than strong alcohol, and insoluble in ether. Extremely bitter, solutions intensely yellow, one part coloring over 1,000 parts of water yellow. Acid and alkalies do not alter the color materially; concentrated sulphuric acid dissolves it easily with evolution of gas. The water solution is precipitated with tincture of nutgalls."

Chelidoxanthin was originally separated from both fresh and dried material as follows: The drug was extracted with water containing a little sulphuric acid for the purpose of removing alkaloids. The dregs were then exhausted with hot water, or until the percolate was no longer yellow. To the concentrated aqueous extract, lead-acetate solution was added until no further precipitate was formed, and then filtered. To the filtrate more lead acetate was added and the lead sulphate decomposed with hydrogen sulphide. The lead sulphide was washed with cold water until the filtrate became colorless and did not possess a bitter taste. Then the sulphide precipitate was boiled repeatedly with water until it was exhausted of yellow color. The combined filtrates were evaporated to dryness, digested with ammonia, then with ether and lastly with dilute alcohol, from which the compound crystallized in crusts.

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[1] Proc. A.Ph.A., 49, 251.

A very small amount of a yellow color body was obtained from Stylophorum diphyllum by a slight modification of the above method. Qualitative tests made with this substance led the writer to believe in the presence of berberine instead of a new principle. The amount at hand, however, was too small to warrant positive statements. In order to more fully study this interesting substance, about eighty pounds of the dried root of Stylophorum diphyllum was extracted by the ammonia-chloroform method, which consists in moistening the dry drug with ammonia water for the purpose of releasing the alkaloids from their natural combinations in the plant, drying at room-temperature, and then exhausting with chloroform. The white alkaloids are very soluble in chloroform while the yellow coloring matter is only slightly soluble.

The chloroform continued to slowly dissolve the yellow coloring matter even after all of the white alkaloids had been removed. After the chloroformic extract had been removed from the receiver, it was noticed that a thin coating of brownish-yellow color had accumulated on the wall of the vessel. A little was removed with a spatula and boiled with water, the latter becoming yellow. Dilute nitric acid almost completely precipitated the yellow coloring matter in the form of fine needles. Potassium iodide precipitated the color so completely that the supernatant liquid was absolutely without color. This reaction pointed to the existence of a salt of some base in which the acid transposed with the hydriodic acid of the potassium iodide. Gordin has shown that berberine breaks up chloroform with the formation of hydrochloric acid, the latter uniting to form the hydrochloride of berberine. The same is true with this color compound, for when the aqueous solution was treated with nitric acid and to the almost colorless filtrate silver nitrate added, a white precipitate formed which readily dissolved in ammonia water. Enough distilled water was now poured into the receiver to completely cover the coating, then heated for several hours, and the liquid filtered. The yellow solution of the hydrochloride was precipitated with dilute nitric acid, the precipitate collected on a filter and thoroughly washed with water. It was then dissolved in hot, 75 per cent. alcohol, slightly cooled and dilute sulphuric acid added in excess. Two volumes of ether were added, the whole shaken and set aside for several hours. Fine needles of the sulphate formed in considerable abundance. By purifying several times, the

color of the sulphate, as well as the hydrochloride and hydriodide, was practically the same as the corresponding salts of berberine.

The quantity of substance so obtained, though considerable, was but a small percentage of that existing in the drug. The remainder was obtained as follows: The drug remaining after extracting with chloroform was exhausted with boiling water, the percolate reduced to small volume and then treated with a large excess of strong alcohol. This removed a large amount of extraneous matter in the form of a stiff, pasty dark-colored mass. The supernatant alcoholic liquid was filtered and reduced to small volume in vacuo. Upon standing, a considerable amount of impure reddish-yellow crystals separated. A still further quantity could be thrown out by means of nitric acid or potassium iodide, but these portions were rather impure and required several recrystallizations.

This color-compound was dissolved in boiling water, filtered and portions converted into the sulphate, hydrochloride, nitrate and into the acetone compound.

The salts of this color-compound, which behave like an alkaloid, crystallize in fine needles of different shades of yellow. They are all quite insoluble in cold water. Hot water dissolves them easily, only to throw them out again in crystalline form upon cooling. Aqueous solutions are turned blood-red in color with strong chlorine water. The solutions are very bitter and are possessed of an intensely yellow color.

In color, taste, solubilities and qualitative tests this color-compound agrees with the alkaloid berberine. Ordinarily, the identification would be complete; but since Gadamer has found colored alkaloids in the Papaveraceæ, which are very similar to berberine in their behavior, it is necessary to be able to make the iridescent scales of the acetone compound to be absolutely certain that we have berberine. This was easily made in quantity from each of the four salts mentioned above and then reconverted into the hydrochloride.

The color-compound of Stylophorum diphyllum before purification agrees with the description of chelidoxanthin of Chelidonium majus. It agrees with the color-compound, which was separated from fresh plants grown for the purpose. Therefore, the writer believes that berberine should be added to the list of alkaloids found in these two plants and the name chelidoxanthin dropped. (Read at the meeting of the A.Ph.A., September, 1902).

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SOME NEW PREPARATIONS CONTAINING SOAP.

By M. I. Wilbert,
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Formic aldehyde has attracted the attention of surgeons, gynecologists and medical practitioners generally, for several years, and quite a number of preparations have been placed on the market, the medicinal properties of which are, or are supposed to be, due to this chemical substance.

Among the more recent and apparently more popular preparations of this class, is a formic aldehyde soap solution. This, or a modification containing some additional antiseptic, has been sold in Europe, especially in Germany, under various trade-names. The representative preparation, and the one that in Germany at least appears to have met with considerable success, is known as lysoform. *Lysoform*, a trademark name for a preparation, the composition of which is a secret of the manufacturer, is advertised as a safe and efficient antiseptic and disinfectant.

The *Pharmaceutische Zeitung* recently (1902, page 749) published a formula for a preparation closely resembling lysoform in its physical characteristics. This formula is as follows:

Cocoanut oil	30 c.c.
Potassium hydrate	8 gm.
Alcohol	10 c.c.
Distilled water	20 c.c.

are mixed together and subsequently heated on a waterbath, with constant stirring, until saponification has been effected. When perfectly clear, and while still warm, sufficient of a 40 per cent. formic aldehyde solution is to be added to make the finished product weigh 100 grammes.

The possible objections to this formula are, that it is rather difficult to get an oil of cocoanut that is readily and completely saponified, and in addition to this, the making of this solution requires the application of heat—something to be avoided if possible. It also entails the subsequent loss of considerable formic aldehyde, if the latter be mixed with warm soap. If the soap is allowed to get cold it will be found to dissolve but slowly in the solution of formic aldehyde.

A solution that answers the purpose as well, and is more readily made, is the following:

Castor oil	75 c.c.
Potassium hydrate	15 gm.
Distilled water	25 c.c.
Alcohol	15 c.c.
Formic aldehyde solution	70 c.c.

Dissolve the potassium hydrate in the water. Add the alcohol to the oil contained in a suitable bottle. To this mixture gradually add the solution potassium hydrate, shaking occasionally; allow to stand until clear and then add the solution of formic aldehyde. This makes a light-yellow solution, the objectionable feature of which is the persistent odor of castor oil.

A more desirable formula, one that is readily followed and contains a higher percentage of formic aldehyde, is the following for a solution that we have designed to name sapoform.

SAPOFORM.

Oleic acid	110 c.c.
Alcohol	60 c.c.
Potassium hydrate	20 gm.
Distilled water	60 c.c.
Formic aldehyde solution, 40 per cent.	250 c.c.

To the oleic acid, in a suitable bottle, add the alcohol. Dissolve the potassium hydrate in the water and add gradually to the mixture of oleic acid and alcohol, occasionally shaking the mixture. Allow the mixture to stand for from twelve to twenty-four hours, then add the formic aldehyde solution.

This formula gives a clear sherry-colored liquid that appears to stand well and is freely miscible with water or alcohol.

As stated above, formaldehyde soap solutions have been used quite extensively in Germany, and are recommended as being antiseptic, disinfectant and bactericidal. They are said to be non-poisonous and non-caustic. In solution, they have been used in place of solutions of corrosive sublimate or carbolic acid. Applied locally for night-sweats of phthisis, and also in cases of excessive perspiration, especially of the feet.

German practitioners recommend 2 or 3 per cent. solutions of the preparation in distilled or soft water.

Sapoform carbolic acid is made by adding carbolic acid one part to sapoform two parts, mix. A preparation similar to this is being used in several of the German hospitals, and according to the published reports, with considerable success.

This is to be used the same as simple sapoform, in 2 or 3 per cent. solution in water.

The water used for diluting any of these antiseptic solutions containing soap is of considerable importance. To obtain perfectly clear solutions the water used should be perfectly pure, or at least free from any of the well-known soap precipitants, such as lime or aluminum.

Petrox or oxygenated petrolatum. Under this name a formula was published in THE AMERICAN JOURNAL OF PHARMACY (1901, p. 220) that appears to have given trouble to some pharmacists. The formula was as follows:

Liquid paraffin (or white mineral oil)	100 c.c.
Oleic acid	50 c.c.
Spirit of ammonia	25 c.c.

Add the oleic acid to the mineral oil, shake well, add the spirit of ammonia and again shake. The only precautions necessary are to use materials that will conform to the U.S.P. tests for purity and strength. It is, of course, essential to use spirit of ammonia and not ammonia water, or spirit of hartshorn so called, as this will not give a clear solution unless the water is evaporated off, a process requiring considerable time and attention.

Petrox iodine, a 6 per cent. solution of iodine in simple petrox. This is readily made, providing, of course, the base has been mixed correctly. If water of ammonia has been used, a clear solution is not readily obtained. If the alkali is in excess, even slightly, the mixture will separate, after the addition of the iodine, into two layers — the upper clear layer being composed of the greater amount of the mineral oil, while the lower layer contains the ammonia soap, iodine and some of the mineral oil in solution. If the acid be largely in excess, it appears to facilitate the precipitation of the iodine.

This preparation, at best, is not a stable one, and cannot be made to be permanent to be efficient. It is readily prepared extemporaneously, the base itself being permanent and stable. This preparation, when fresh and free from precipitated ammonium iodide, is such an efficient and eminently satisfactory one that it should readily appeal to pharmacists as a point to make with physicians in their neighborhood.

Ammonia soap may also be utilized in making a preparation to sell as a *clothes cleaner* or grease chaser.

Fifty cubic centimeters oleic acid, 25 c.c. ether, 25 c.c. chloroform, 250 c.c. benzine and 50 c.c. spirit of ammonia are mixed in the order given, with occasional shaking. If a white emulsion is preferred, the same or double the amount of water of ammonia may be substituted for the spirit, the excess of alkali in this case being rather an advantage.

Saponaceous menthol solution.—H. Kuhl (*Phar. Zeit.*, 1902, p. 710) gives a formula for a preparation of this kind, as follows:

Menthol	1 gm.
Chloroform	5 c.c.
Spirit of camphor	10 c.c.
Alcohol	20 c.c.
Soft soap (U.S.P.)	15 c.c.
Oil of wintergreen	2 c.c.

Mix.

This makes an agreeable and cooling lotion that may in many cases be recommended in place of menthol cones, or menthol pencils, for neuralgias or headaches.

ON SOME RECENT ADVANCES IN THE FIRE-PROOFING TREATMENT OF WOOD.[1]

By Samuel P. Sadtler.

The saturation of wood with chemical solutions has mainly two objects in view, either to prolong the life of the wood by rendering it as resistant as possible to decay, or to make it resistant to the attack of fire and to cause it when exposed to flame to carbonize as slowly as possible without, of or from itself, contributing to the increase of the flame. We will take up the second of these two lines of treatment for present discussion.

The treatment of wood with a view of making it fire-resistant is not a matter of recent years. The Bavarian chemist Fuchs in 1820 applied the newly discovered silicate of soda to the fire-proofing of wood and employed it in the rebuilding of the Munich Theatre for the treatment of both the wood work and the hangings of the theatre. Gay Lussac in 1821 suggested the salts of ammonia and

[1] Read before Section C of the American Association for the Advancement of Science, Pittsburg meeting, June, 1902, and reprinted from *Science*, September 12, 1902.

borax. Tungstate of soda also figured at an early date in the list of fire-proofing salts as well as the salts of zinc and the chlorides of the alkalies and calcium and magnesium. Antedating all of these, however, going back indeed to the records of ancient Greek and Rome, was alum, which has always been a favorite fire-proofing material, used both alone and in admixture with other compounds.

All of these materials can under circumstances exert a notable fire-retarding effect and have served as the basis of a variety of patented processes for the treatment of wood.

But we must not lose sight of the fact that the problem of satisfactorily impregnating wood for fire-proofing purposes is a mechanical as well as chemical one, and it will be best to look at the mechanical side of it for a few moments. The typical apparatus, until recently employed everywhere wherewith to saturate lumber with fire-proofing solutions, was a large cylinder, running from 60 inches diameter and 70 to 80 feet long to 84 inches diameter and 105 feet long, closed at one end, with a movable head at the other, swinging horizontally or lifting vertically to open or close. It was fastened when closed by a complicated system of radial bolts to the external end of the cylinder. The cylinder itself, composed of steel plates riveted together, was intended to be filled with truck loads of lumber, and when the entrance door was closed and locked the wood was subjected, after some preliminary treatment, to hydraulic pressure through the medium of the treating solution, which envelops the surface of each piece of lumber and which the pressure was intended to force into it at every point.

With cylinders of such enormous diameters and riveted plates, the pressure that can be withstood is relatively light and as a consequence the time of saturation is necessarily long.

The preliminary treatment before referred to is usually a steaming of the wood followed by application of a vacuum for the purpose of facilitating the final step of impregnation. A pressure of 150 pounds is quite as much as can be maintained as an average in such a cylinder, and to effect a complete saturation, even with soft woods 1 inch thick, requires in such a case from 36 to 40 hours. A core saturation in heavier timbers, such as 4 x 4 inches or 6 x 6 inches, is rarely if ever obtained even in soft woods, and never in the hard woods.

A radical improvement upon this method of working was effected

by Mr. Jos. L. Ferrell, of Philadelphia, in the invention of the apparatus now in use by the U. S. Fire-proof Wood Company of Philadelphia, and which was described and figured in the *Scientific American* of July 28, 1900. By the replacement of the hinged gate by a heavy gate, sliding between vertical guides against a phosphor-bronze bearing and placed in a massive gate housing near the end of the cylinder, which is of heavy cast tubing, he was able to use pressures ranging from 400 to 1,500 pounds in extreme cases. By the intervention of a hydraulic accumulator he was able to perfectly cushion the shock of the high-pressure pumps so as to prevent all bruising of the wood when under strong pressure. No preliminary steaming or vacuum is necessary, but after the receiver is full of liquid and the pressure is applied, the liquid penetrates and, in what seems an incredibly short space of time, has followed the medullary rays from end to end of the lumber and effected what is bound to be a thorough core saturation. One hundred per cent. saturation (weighed wet) is readily effected in ten minutes, and after the kiln drying the permanent gain in the weight of the wood will be found to be from 5 to 10 per cent., distributed throughout its whole cellular structure and not on the surface or in the exterior layers only.

Hard woods in large sizes up to 12 x 12 inches have been so treated, and upon being sawed through have been found to have perfect heart saturation.

With the mechanical side of the fire-proofing treatment thus perfected, let us turn again to the choice of a chemical which shall prove as fire-resistant as possible and impart this quality to the wood. Some of the qualities that such a chemical should possess may be briefly reviewed.

(1) It must not be of a hydroscopic nature, because in such case it would destroy paint and keep the surface of the wood in an undesirable moist condition. For this reason the chlorides of calcium, magnesium and zinc are excluded, although an attempt has been recently made in a German patent to produce for this purpose a basic chloride of calcium which it is claimed is free from this drawback, and is recommended for fire-proofing of wood.

(2) It must not be a volatile substance, because in such case it will gradually be liberated from the cells of the wood and show as an efflorescence, besides leaving the wood after a time weaker in its fire-resistant character. The ammonia salts, notably the sulphate

and chloride, will not stand this test at all satisfactorily. In the dry kiln, the liberation of ammoniacal gas begins already at 125° F., and the efflorescence is frequently recognizable even when the surface has been varnished if the wood has been exposed to strong sunshine for any length of time. Of course, such efflorescence speedily ruins the appearance of a varnished wood.

(3) The chemical used must not allow of fungous growth, for in such case the wood will decay more rapidly than untreated wood. Here again the ammonia salts, including the phosphate as well as sulphate, are unsatisfactory, as when the conditions of warmth and moisture are favorable the treated wood develops a fungus rapidly and deteriorates in strength.

(4) If possible, the chemical should have exactly the opposite character, viz., a distinct preservative effect, so that the life of the treated wood should exceed that of untreated wood.

(5) There should be no noxious gas liberated in the heating or carbonizing of the wood.

(6) The chemical used must not be poisonous in character, so that splinters impregnated with it, if by accident run into the flesh or wounding it, shall not endanger life or health.

(7) It should not cause the corrosion or rusting of metals which in the form of screws or bolts are passed through it.

(8) The cost must be moderate, as its practical utilization will be barred if the materials be such as to make the process an expensive one.

After a most exhaustive series of experiments, extending over several years, with a wide range of compounds, Mr. Ferrell, the inventor of the fire-proofing method just referred to, has found in sulphate of alumina a compound that appears to answer all the requirements as stated. It has the additional feature, of no slight importance in its bearing upon the fire-proofing effect, that when strongly heated it leaves an infusible and non-conducting residue to cover and protect the cellular structure throughout the wood. It absolutely prevents the propagation not only of flame throughout the wood but even of a glow because of its non-conducting and unalterable character.

Sulphate of alumina in concentrated solution is far more efficient than an alum solution; in fact, it would seem as if the alkaline sulphate of the alum simply detracted from the power of the aluminum sulphate in the matter of making wood fire-resistant.

I have before referred to the way in which sulphate or phosphate of ammonia acts to make wood fire-resistant, viz., by rapidly liberating ammonia gas, which has the effect of checking the flames on the surface of the wood. The fiercer the flame which plays against such wood the more rapid the liberation and exhaustion of the protecting vapor. There is no residual protective substance remaining in the wood, and the carbonization of the fibre proceeds apace.

On the other hand, so soon as the sulphate of alumina of the superficial layer of the wood impregnated with this chemical is decomposed by the heat of a flame, a deposit of alumina is formed, the non-conducting properties of which make it a barrier against the propagation of the carbonizing effect and protect the interior in a very notable degree. An actual experiment, one of a large number which I carried out jointly with the inventor, will illustrate this. If a piece of wood be saturated with a solution of sulphate of alumina of 30° B. strength to a depth of not more than 3/8 of an inch from the surface and the point of the inner blue cone of a strong Bunsen flame be made to impinge upon it and kept in such a position, a boring effect takes place, while an abundant separation of alumina will be observed. The average resistance of a piece of 1-inch white pine so treated to the complete boring result, with final penetration of the flame to the other side, will be over three hours. If a similar piece of 1-inch white pine be "heart-saturated" with ten times the quantity of sulphate of ammonia and the same Bunsen flame be applied under exactly similar conditions, the average resistance to complete penetration will not be over seventy minutes. These results have been obtained repeatedly and in instances the disproportion was much greater.

Some very interesting observations have been made on the physical changes which the fireproofing material undergoes on the continued application of heat. As a result of repeated measurements, it is found that the residual alumina occupies a space from two and a half to three times as great as the dried salt from which it is formed. Hence in forming it apparently expands to fill out the air spaces and intercellular spaces of the wood very fully. This results in the formation of a very compact non-conducting barrier which interposes itself to the action of the flame and protects the layers of woody tissue upon which it is formed. The protection is therefore a real and much more lasting one than that which could come

from the liberation of a gas whose action, from the nature of things, could be evanescent only.

In working on a large scale, where heavy timbers or boards in the rough are treated, the saturation with the sulphate of alumina solution is always carried out until complete "heart saturation" is attained, as the wood has to be sawed, planed, mortised and otherwise worked and cut into, and all surfaces that will be exposed later must be fire-resistant to the fullest degree.

As, irrespective of the large number of both soft and hard woods that, because of their practical value, had to be tested, the same kind of wood will differ greatly in its physical characters, according as it may be heart-wood or sap-wood, and according as it may be young wood or thoroughly matured, a vast number of saturation tests have been made in establishing the efficiency of the different methods of working and the value of different solutions. No deduction has been thought to be of value that was not based upon a large number of tests carried out under similar conditions so as to obtain an average that could be relied on. The immensity of the task may be understood when it is stated that 80,000 saturations and fire tests with complete attending records have been made of different thicknesses of nineteen different varieties of wood and forty-six chemical formulas, requiring the constant application of the inventor and his assistants and running through a period of over six years.

One remaining question, and a very important one, is what effect has the fire-proofing treatment upon the structural strength of the wood? When the older method of saturation, whereby the wood was steamed and then subjected to pressure for long periods, was the only one available, it was recognized that a compression of the cellular structure of the exterior layers of the wood took place so that the wood was distinctly weakened and the results for tensile strength and bending and breaking tests were accepted as necessarily lower than for the same wood untreated. With the superior method of impregnation now adopted, however, no such allowance is necessary, and the treated wood is in no way inferior in strength to the untreated. Professors Mason and Bliss, of the University of New York, have made a large number of physical tests upon the wood treated by the Ferrell process and have established this important fact very fully. The whole matter, however, of the fire-

resistant properties of wood treated by different processes, together with physical tests upon the same, is now under investigation by a commission appointed by the Bureau of Building Construction of the City of New York, and I have no doubt that their report when published will throw much additional light upon this most important subject.

PHILADELPHIA, July, 1902.

TRI-BASIC SODIUM PHOSPHATE.

BY H. B. EIGELBERNER.

In looking through a number of chemical text and reference books, I find practically no mention of Tri-Basic Sodium Phosphate ($Na_3PO_4+12H_2O$).

Inasmuch as the consumption in this country alone amounts to between three and five million pounds yearly, it seems to the writer that the subject is worthy of more notice than has previously been accorded it. The ingredients of this manufacture are: sulphuric acid, phosphate rock, soda ash and caustic soda.

The three stages of the operation are shown by the following reactions:

$$Ca_3(PO_4)_2+3H_2SO_4=3CaSO_4+2H_3PO_4.$$
$$H_3PO_4+Na_2CO_3=Na_2HPO_4+H_2O+CO_2.$$
$$Na_2HPO_4+NaOH=Na_3PO_4+H_2O.$$

The above reactions are more or less ideal, and no account is taken of the minor reactions between small amounts of the calcium acid phosphate and the phosphates of iron and alumina, carbonates, etc.

The details of its crystallization and the appearance of the final product are very similar to the familiar di-basic sodium phosphate ($Na_2HPO_4+12H_2O$).

Probably one-half the T.S.P. (tri-sodium phosphate) manufactured goes into the different boiler compounds, the rationale of its use being to convert the hardenable carbonates and sulphates of lime, magnesium and other incrusting minerals into unhardenable phosphates and to neutralize the acids released by decomposition. $3(CaSO_4+2H_2O)+2(Na_3PO_4+12H_2O)=Ca_3(PO_4)_2+3(Na_2SO_4+10H_2O)$. A corresponding reaction takes place in the carbonates—sodium carbonate in solutions and calcium phosphate precipitated.

As it renders the water perfectly clear and soft, large quantities of T.S.P. are now used in the laundries, and as a washing-powder for household use; some of the claims for it being that it saves labor, removes fruit stains, cuts grease and saves about 50 per cent. of soap.

Tri-sodium phosphate is used in creameries to cut the scum from milk cans, and in a small way to clarify water (in place of alum).

During the past year it has been used in large quantities (under different brand names) either straight or in combination with borax and other chemicals as a "casein solvent."

Tri-sodium phosphate, as found on the general market, runs between 95 and 99·5 per cent. pure. The impurities (incidental to manufacture) are, chloride, sulphate and carbonate soda. It is sometimes found adulterated with 10 to 40 per cent. glauber salt or soda ash.

PROGRESS IN PHARMACY.

A QUARTERLY REVIEW OF SOME OF THE MORE IMPORTANT ADVANCES IN PHARMACY AND MATERIA MEDICA.

By M. I. Wilbert,
Apothecary at the German Hospital, Philadelphia.

What will probably prove to have been an event of far-reaching importance, at least to the pharmacist who is interested in the development of the professional side of his occupation, was the meeting of "*The International Conference for the unification of potent drugs and preparations*," in Brussels, from the 15th to the 20th of September.

This congress was attended by representatives from Austria, Belgium, Bulgaria, Denmark, France, Germany, Great Britain and India, Greece, Holland, Hungary, Italy, Luxemburg, Norway, Portugal, Russia, Spain, Sweden, Switzerland and the United States of America. Many of these countries were represented by members of their respective Pharmacopœial Revision Committees, and all of the delegates were present as the official representatives of their respective governments. This latter fact gives to the deliberations and recommendations of this conference a prestige that will contribute materially to their adoption by the Pharmacopœial Revision Commissions of the various European countries.

While the recommendations finally acted on by the conference are necessarily conservative, they are advances in the right direction. A general acceptation of these recommendations by the different Pharmacopœial Revision Committees would be a deserving tribute to the work done by the conference, and also contribute materially to do away with many unnecessary and, at the present time, dangerous differences in the strength of galenical preparations.

That these recommendations will receive due consideration, especially on the continent of Europe, is evident from the tone of editorial comments in the medical and pharmaceutical journals.

In the protocol, as adopted and signed by all the delegates present, the following general principles are included:

A normal drop measure should be adopted, of which the exterior diameter of the dropping tube should be exactly 3 mm. or one that (at a temperature of 15° C. and with distilled water) will give 20 drops to 1 gramme.

Potent medicaments should not be prepared in the form of wines. Tinctures of potent drugs should be prepared at 10 per cent. and by percolation.

Fluid extracts should be prepared at 100 per cent.

The recommendation regarding tinctures of potent drugs contains a graceful tribute to the progressiveness of American pharmacy, percolation having been used for many years in the preparation of all available preparations.

The recommended strength of these potent tinctures is a subject well worthy the careful consideration of the present Pharmacopœial Revision Committee. It would not be in keeping with our general reputation for progressiveness if the United States Pharmacopœia should be the last, instead of the possible first, of the official standards to comply with the recommendations of this conference for unifying the strength of these potent preparations.

This particular question appears of still greater importance when we consider the probably very active part that this country will take in the development of the world's resources during the next decade.

Among the drugs that were discussed and acted on, the commission recognized the acceptable botanical source, and Latin titles of the following crude drugs: Aconite, Colchicum, Digitalis, Ergot, Hyoscyamus, Ipecac and Nux Vomica. Opium was adopted as the

powdered drug assayed to contain 10 per cent. of its weight of morphine. Processes for the following extracts were accepted: Belladonna, Ergot, Hyoscyamus, Nux Vomica and Opium. The first and last of these are to conform to an established standard of alkaloidal content.

Among the other galenical preparations acted on were: Fluid Extract of Ergot, Ointment of Mercury (30 per cent.), Powder of Ipecac and Opium (10 per cent. of Opium), Syrup of Ipecac (10 per cent. of Tincture), Syrup of iodide of iron (5 per cent. ferrous iodide).

The following tinctures, all to be of 10 per cent. strength, are included: Aconite, Belladonna, Cantharides, Colchicum, Digitalis, Hyoscyamus, Iodine, Ipecac, Lobelia, Nux Vomica, Opium and Strophanthus, also a proposed formula for Opium Benzoated (Camphorated U.S.P.).

In addition to these preparations, the following chemicals, or preparations containing chemical substances, were included: Wine of Antimony, Dilute Hydrocyanic Acid (2 per cent.), Solution of arsenite of potash (1 per cent. of arsenous acid), Sodium arsenate, Cocaine hydrochlorate.

One other item of interest is the negative action on the proposed recommendation of crystalline aconitine and digitaline. In this connection the ruling was that "active principles (alkaloids or glucosides) should only be admitted when they can be obtained as chemically pure crystalline products.

The annual meetings of pharmaceutical and other scientific societies have contributed materially to our store of scientific and practical knowledge. The meeting of the British Pharmaceutical Conference at Dundee, the meeting of the American Pharmaceutical Association at Philadelphia, and the Versammlung der Deutschen Naturforscher und Aerzte, at Carlsbad, were the representative gatherings in these various countries.

While the first two associations had contributed to them much of a practical and even commercial nature, the German Association is devoted almost exclusively to the development of scientific subjects. The society itself covers a very wide field of scientific research, and the practical work is divided among twenty-eight sections.

The proceedings of the Pharmaceutical Association, as well as the British Pharmaceutical Conference, have been reported and com-

mented on so recently that any additional remarks at this time would be superfluous. As noted above, the seventy-fourth general meeting of the German Naturalists and Physicians was held at Carlsbad, from the 21st to the 27th of September, 1902. Among the numerous papers that were presented before the Section on Pharmacy and Pharmacognosy, the following are of more particular interest to the pharmacist.

Opium, Persian.—P. Siedler, Berlin, suggests that in consideration of the fact that Smyrna opium is being so extensively adulterated, more attention be paid to the possible use of the better grades of Persian opium, in the making of galenical preparations.

Horse-Chestnut, Examination and Possible Uses for.—Dr. E. Laves, Hanover, calls attention to the food-value of horse-chestnuts and to the possibility of making this food available by removing the saponin, bitter principle and other objectionable ingredients by means of alcohol. This alcohol extract has been recommended as being possibly useful in medicine.

The Saponin of Lychnis Flos Cuculi.—Dr. P. Süss. This writer refers to the wide distribution of saponin in vegetable drugs, and then reports his method of separating the saponin from the fresh flowering herb of *Lychnis flos cuculi.* The resulting amorphous powder, amounting to 0·2 per cent. of the fresh herb, the writer calls "Lichnidin," and reserves a report of a chemical study for a future occasion.

Quantitative Estimation of Caffeine.—Dr. J. Katz, Leipzig, gives a modification of Beitter's method for estimating caffeine so as to make it available for roasted coffee, roasted kola nuts or Paraguay tea.

Change in Alcoholic Tinctures.—Dr. Richard Firbas, Vienna, calls attention to some of the possible changes that may be and are occasioned by plant ferments and analogous bodies in alcoholic tinctures containing them.

Yohimbin.—Dr. P. Siedler gave a résumé of the work that had been done on, and the literature of this alkaloid, obtained from a species of Tabernæ montana, used medicinally in aphrodisiac mixtures.

Among the novelties that were reported on at the other sections, probably the most interesting was a report from Dr. Paul Moser, before the Section on Pediatrics, on the successful use of a serum in the treatment of scarlet fever.

Scarlet-fever serum has, according to Dr. Moser, been used very successfully in a series of eighty cases in Vienna.

The Pharmaceutical Society of Japan.—The remarkable progress made in scientific training and thought in the Far East is well illustrated in a small pamphlet giving an outline history of the rise and development of the Pharmaceutical Society of Japan. The Society was founded in October, 1878, as the Tokyo Pharmaceutical Society, with a membership of 49. In 1892 this membership had increased to 482, and the Society, that had developed from a purely local one to one of national scope, was renamed the Pharmaceutical Society of Japan. In 1901 the Society had a membership of 2,059. The journal of the Society, which originated in 1881 with a total of 35 pages, in 1901 comprised 1,392 pages, including 29 original articles that occupied 279 pages.

To make these original articles available for reference to the European and American readers and students, a very creditable series of abstracts in English accompanies each number of the journal.

Antidecubin.—A heavy sheet of felt, that is recommended to be used as a preventive of bedsores, is applied very much in the same way that corn and bunion plasters are—a suitable hole in the felt relieving pressure on any portion of the surface of the body, and in this way preventing laceration and subsequent breaking down of the outer skin

Antithyreoidin, or thyreoid serum, has been commented on favorably. It is said to be the serum from sheep that, some six or eight weeks before being bled, have had their thyroid gland removed. The serum is preserved by the addition of small quantities of carbolic acid. The dose is from 0·50 gradually increased to as much as 2·00 c.c. three times a day, given in sherry, or, according to Moebius, preferably in elderberry wine, for Graves' disease, cretinism and myxœdema. (*Pharm. Centralhalle*, 1902, p. 495.)

Bay Rum.—The *Deutsche Apotheker Zeitung* (1902, p. 491) brings a formula that, while it does not differ materially from that given in the U.S.P., is manipulated differently and gives an agreeable and clear product.

Oil of bay	33· c.c.
Oil of orange	2·5 c.c.
Oil of pimenta	2· c.c.
Alcohol	2,000· c.c.

After dissolving the oils in the alcohol, mixed in a suitable bottle, the mixture is allowed to stand for twenty-four hours, occasionally shaking. Then add

Water	1,500· c.c.
Calcined magnesia	25· gm.

Shake occasionally, and allow to stand for another twenty-four hours. Filter.

A perfectly clear and sparkling product is much more readily obtained than with the U.S.P. process.

Bismutose.—Reinhardt (*Pharm. Zeitung*, 1902, p. 637) gives an outline of the method of preparation and the physical properties of a trade-marked and patented substitute for subnitrate of bismuth. Bismutose, from this description, appears to be an unstable mixture of bismuthyl and albumin, and is supposed to have the advantage of being absolutely innocuous even in continued large doses.

Croton Oil, detection of, in tincture of iodine. Durien (*Pharm. Centralhalle*, 1902, p. 447, from *Bulletin des Sciences Pharmacology*) directs that 70 grammes of water be added to 10 grammes of the suspected tincture of iodine. An excess of iron filings is then added to combine with the iodine present, forming iodide of iron. The solution is then thoroughly well shaken with a small quantity of ether, and this is later allowed to evaporate. The presence of a fatty oil is indicated by a residue, which residue may be tested for its identity by its action on the skin, odor, and brown coloration with sulphuric acid.

Diosmal.—Under this title Paul Runge (*Pharm. Centralhalle*, 1902, p. 465) describes the physical properties and an outline of the preparation of a petroleum ether-alcoholic extract of buchu leaves. This preparation is made by successively extracting buchu leaves with petroleum ether and strong alcohol, distilling off the solvents and ultimately mixing the residual extractives. Dose, 0·10 or more three times a day.

Hellebore.—A. Tschirch communicates (*Schweiz. Wochenschr.*, 1902, p. 410) a comparative study of a number of varieties of hellebore rhizomes made with the assistance of E. Neuber. This paper includes a study of the rhizomes and roots of *Helleborus viridis*, *Helleborus niger*, *Helleborus fœtidus*, *Helleborus caucasicus* and *Helleborous purpurascens*. The writers also call attention to and describe a number of drugs that are sometimes mistaken for or substituted for hellebore.

Isarol, formerly called ichthyodin, a Swiss, and *Petrosulfol*, an Austrian substitute for ichthyol, are both said to be obtained from the same base, and to correspond to all the requirements of the Swiss Pharmacopœia for ammonium sulfoichthyolicum.

Lecithol is the trade-name for a preparation of lecithin made by the chemische fabrik J. D. Riedel, Berlin. Lecithin, the name applied to the widely distributed combination of glycerinophosphoric and fatty acids with cholin, has attracted quite considerable attention during the past year, and it is quite probable that the near future will see a number of preparations on the market, of which this appears to be one of the first.

Local anesthetics: Substances that have local anesthetic properties are always of interest. Among the chemical substances that have been experimented with in this direction are:

Dionin.—Darien (*Jour. des Practiciens*, 1902, p. 131) has employed a 1 per cent. solution of dionin in the eye for the relief of pain. Darien also recommends dionin for the relief of pain caused by a decayed tooth.

Acoin.—Darien in the same article also says that this substance produces local anesthesia only when the epithelium is destroyed. Its action is said to be slower and more prolonged than cocaine. It has been employed as a local anesthetic in connection with subcutaneous injections of irritating substances, such as corrosive sublimate or iodine. Satisfactory results have also been obtained by mixtures of cocaine and acoin.

Mesotan, a derivative of salicylic acid (the alkyloxymethylester of salicylic acid), is offered as a substitute for methyl salicylate and true oil of wintergreen for external use. It is said to be free from the objectionable and persistent odor of oil of wintergreen, and preferable on this account. Mesotan is soluble in ether, alcohol, or fatty oils, and is said to be readily absorbed through the unbroken skin (*Pharm. Centralhalle.*, 1902, p. 506).

Pancreatized Cod-Liver Oil.—The *Chemist and Druggist* (according to the *Pharm. Zeit.*, 1902, p. 639) brings the following formula:

Cod-liver oil	150 c.c.
Water	50 c.c.
Extract of malt	200 c.c.
Pancreatin (soluble)	1 gm.
Sodium chloride	2 gm.
Sodium bicarbonate	2 gm.

Dissolve the pancreatin and the salts in the water and emulsify with the cod-liver oil and the extract of malt.

Phenosalyl.—Cambe (*Rept. de Pharm.*, 1902, No. 8) gives the following formula for this substance:

Carbolic acid, crystals	60 gm.
Lactic acid	5 gm.
Salicylic acid	5 gm.
Glycerin	20 c.c.
Borax	8 gm.
Menthol	1 gm.
Eucalyptol	1 gm.
Thymol	1 gm.

The borax is dissolved in the glycerin by aid of heat; the acids are then added to the warm solution of borax. After cooling, add the menthol, eucalyptol and thymol.

Pyridin Tannate.—According to Dr. Braeutigam (*Pharm. Zeit.*, 1902, p. 498) this is a valuable uric-acid solvent, and may also find application as an intestinal astringent.

The preparation, according to the same author, is made by pouring a pyridin solution into an excess of solution of tannic acid, care being taken that the temperature does not exceed 10° C. The resulting precipitate is washed with cold water until the water does not give any perceptible reaction with pyridin solution; the material is then dried at a temperature of 20° to 25° C. and preserved in the dark.

Strychnicin, a new strychnos alkaloid, has been reported on by G. Boorsma (*Pharm. Zeit.*, 1902, p. 608 from *Pharm. Jour.*). It occurs in the leaves, pulp, thin epidermis and rind of the fruit of Strychnos nux vomica.

The chemical formation and physiological action of strychnicin have not been fully studied, but it is said to be comparatively non-toxic. With concentrated sulphuric acid it gives a colorless solution that is not changed by addition of oxidizing agents like potassium bichromate or potassium permanganate.

RECENT LITERATURE RELATING TO PHARMACY.

THE RECORDED HISTORY OF THE MEMBERS OF THE ARGON GROUP.

This is the title of a paper by Henry P. Talbot, published in the "Technology Quarterly," for June, 1902, page 195. In this paper the writer presents a review of physical and chemical, as well as historical data.

The amount of interest that these new elements have excited is well illustrated by the closing paragraph of the paper, in which the writer states, that since the discovery of Argon, no less than 250 magazine articles have appeared relating to one or more members of this group. The following facts and figures have been culled from this interesting and comprehensive review:

Argon.—The circumstances that lead up to the discovery of this element may be found in the fact that Lord Rayleigh, in the course of some experiments, had noted that atmospheric nitrogen appeared to have a greater density than nitrogen obtained from chemicals, such as nitric acid, nitrous oxide or ammonium nitrite. Suggestions and explanations were numerous but unsatisfactory, and it was finally decided to determine whether or not there was an unknown heavier element in the atmospheric nitrogen.

In making these investigations Lord Rayleigh had associated with him Professor Ramsay, of University College, London. After a long series of carefully planned and executed experiments, Lord Rayleigh and Professor Ramsay, on January 31, 1895, made the announcement, at a meeting of the Royal Society in London, that they had discovered a new element in the atmosphere, to which, on account of its inert character, they had given the name Argon. The quantity of this element, present in the atmosphere, appeared to be about 1 per cent. of the contained nitrogen, or about 0·9 per cent. of the atmosphere. Assuming that the density of Argon was about 20, it would explain the greater density of atmospheric compared with chemical nitrogen. Argon has since then been found in one specimen of meteoric iron, in a variety of minerals and in the waters, or escaping gases, from a number of springs in different parts of Europe.

So far it has not been definitely demonstrated to have any chemical properties. Its physical properties, that is, its spectrum, its specific gravity and the atomicity of its molecule have been the subject

of much research and discussion. Its spectrum for instance appears to vary with the nature of the electrical energy that is used to energize the gas, and is admittedly complex and varied. This complex nature of the spectrum, as well as the accompanying variations, has been made a basis for arguments against the elementary character of Argon.

The density of Argon has been carefully determined by Ramsay, who, as the result of numerous experiments, announced 19·96 as the true value for the density of the gas; this would correspond to a molecular weight of 39·92 (O = 16).

Helium.—This element was first noticed in the spectrum of the chromosphere during an eclipse in 1868, by Jannsen, who noted a brilliant yellow line, which was close to but not identical with the well-known *D*-line of sodium. This he designated as the D_3-line, and in the same year Lockyer assigned the name "Helium" to the hypothetical element, of which this line was characteristic.

While this line has been repeatedly observed since then, by projecting the image of the edge of the sun, on the slit of a spectroscope of wide dispersion, and has also been found in the spectrum of some of the fixed stars and nebulas, it had never been demonstrated to exist among terrestrial elements.

After the discovery of argon, Mr. Myers, the mineralogist of the British Museum, wrote to Professor Ramsay, calling his attention to the fact that cleveite (a uranate of lead, thorium and uranium) had been shown by Hillebrand to contain nitrogen. Myers offered the suggestion that this mineral might contain argon or might have some constituent capable of entering into reaction with argon.

This suggestion was later adopted by Professor Ramsay, who demonstrated that the resulting gas, after removing the nitrogen, not only contained argon, when subjected to spectrum analysis, but also showed a new series of lines in the red, green, blue and violet and notably a brilliant yellow line. Ramsay later sent the gas to Crookes for examination and he in turn reported that the bright yellow lines were undoubtedly due to helium. Experiments made gave 3·89 as the maximum density of the gas, and the ratio of the specific heats was found to approximate 1·66.

The gas is then, as was to be expected from its existence in the chromosphere, very light, and it appears to be monatomic.

Helium has been found in a number of minerals, almost all of

which contain either uranium, yttrium or thorium. It has also been found in the gas emanating from several of the European thermal springs and has been definitely proven to exist in liquid air. From observations that have been made it has been determined that this element is one of the constituents of our atmosphere in the ratio of 1 or 2 parts in a million. The latest determinations of its density appear to make it about 1·98 and its atomic weight about 3·96.

Other Members of the Group.—Professor Ramsay, in a lecture before the Deutsche Chemische Gesellschaft in December, 1898, gave an account of the steps which led to the discovery of the other members of the group.

The search for these elements was occasioned by an attempt to fit argon and helium into the periodic system. If 4 and 40 were assumed to represent the atomic weights of helium and argon respectively, there would be a space to be filled by an element having an atomic weight about 16 higher than helium.

The quest, begun by Ramsay and Collie and continued by Ramsay and Travers, opened with a careful re-examination of the minerals which had proved to be a source of helium. The search was later extended to other minerals of different chemical character, but with uniformly negative results. Meteorites and the gases from mineral springs were equally unproductive.

Attention was then turned to argon, and its study in connection with liquid air. It was pointed out that the atomic weight of argon would be more tractable if it could be reduced to below 40, and a search after a constituent of the air having a lesser density than 20 seemed worth the making.

In preparing to liquefy a quantity of purified argon, with the aid of liquid air, it was thought worth the while to examine the last fractions of some evaporating liquid air. After removing the oxygen and the residual nitrogen, Ramsay found that there were present, in the spectrum of the residual gas, a number of the new lines, notably a yellow line not identical with that of helium, and a new green line. The gas had a density of 22·5 instead of 20 and the ratio of specific heats of the mixture of gases was found to closely approximate 1·66. Here, then, was a new element or elements, but not the one sought for. Ramsay, assuming the presence of one only, gave it the name "Krypton" (the concealed one).

This gas has been studied more closely since that time. It is

estimated to be present in the atmosphere in the ratio of about 1 part of gas to a million of air. The density of the gas is estimated to be about 40·78 and its atomic weight 81·56.

In the subsequent experiments that were made with liquid argon it was found that the first fraction, from the boiling argon, had a density of 14·67 and a ratio of specific heats of 1·66; the spectrum showed, beside the lines of argon, a number of new lines of red, orange and yellow of marked brilliancy. After some further separation of the contained argon the density was found to be 9·76. This new gas, which was designated as "neon," while it still contained a fraction of argon, also contained helium, which would tend to decrease the density of the mixture somewhat.

Later experiments appear to indicate that this gas has a density of about 9·96 and an atomic weight of about 19·92. It is present in the atmosphere to the extent of from 10 to 20 parts in a million. The less volatile portions of the liquefied argon they considered to contain at least two additional elements besides krypton and argon. To one of these they gave the name "Xenon" (stranger), and while they did not have an opportunity to study it in a perfectly pure condition, they determined its density as being from 40·5 to 41·1. Later investigations appear to indicate that xenon has a density of about 64 and an atomic weight of 128. It must be considered as an extremely rare element occurring in the atmosphere in the proportion of $\frac{1}{20}$ of 1 part to a million of air.

The fourth component of the less volatile portion was given the name "metargon." It was a source of much perplexity, as its spectrum was found to resemble the so-called "swan spectrum" of carbon monoxide. Subsequent study showed that the supposed new element was indeed carbon monoxide which had been introduced by accidental impurities in the chemicals used.

All of these elements are gases and all are chemically inert; it would appear self-evident, therefore, that they would form a distinct class of their own; but how to fit them into the existing periodic system developed a problem that has been attacked by several eminent European scientists, and has also been the cause of considerable discussion pro and con as to the elementary character of these substances, and the correctness of the available data concerning them.

Several schemes have been proposed to fit them into the periodic

system in a rational and satisfactory way. The one proposed by Ramsay is given below:

H	He	Li	Be
1	4	7	9
F	Ne	Na	Mg
19	20	23	24
Cl	A	K	Ca
35'5	40	39	40
Br	Kr	Rb	Sr
80	82	85	87
I	X	Cs	Ba
127	128	133	137

It will be noted that hydrogen, according to this arrangement, becomes the first element in the halogen group—a position for it which had been suggested by several eminent scientists.

The inert argon group, according to this classification, would hold the position between the very active halogen and the sodium groups.

M. I. WILBERT.

INTERNATIONAL STANDARD OF POTENT REMEDIES.

Among the basic principles discussed and subsequently adopted by the International Convention for the Unification of the Formulas for Heroic Medicines, which met at Brussels, September 15th, none perhaps is of more direct interest to the American medical practitioner than that establishing at 10 per cent. the strength of tinctures of active or potent remedies. This is especially opportune with the present revision of the U. S. Pharmacopœia. The importance of the subject is emphasized in an article on tincture of aconite read at the meeting of the American Pharmaceutical Association held recently in this city by M. I. Wilbert, apothecary to the German Hospital. He points out that the U.S.P. tincture of aconite is seven times as strong as the British preparation, three and a half times as strong as the German preparation, and nearly double the strength

of the French preparation. That it has been recognized that the strength of the U.S.P. tincture is excessive, is shown by the repeated reduction of the percentage. The tincture originally represented 65 per cent. of the crude drug, and was reduced in 1850 to 50 per cent., and in 1860 to 40 per cent., where it remained until 1890 when it was reduced to 35 per cent. We understand that there is now a movement to return to 40 per cent., for no reason other than that 40 per cent. is the official strength of the tincture of veratrum viride. The tinctures of many other potent drugs are from 50 per cent. to 100 per cent. stronger than the proposed international standard. These variations in strength become of very serious moment when we consider the potency of the preparations, their widespread use, and the fact that foreign medical literature is freely abstracted and liberally commented upon in medical journals. Comparatively few physicians are in a position to familiarize themselves with the differences in the strength of galenic preparations in different countries—hence, the possibility of serious consequences from the use of potent remedies in dosage advocated in foreign publications. A uniform standard should be adopted, and this standard should be international as well as national. For instance, were tincture of aconite reduced to the same strength as tincture of belladonna, it could be administered in the same dose, and—a matter of some importance—the difference between the average medicinal dose and the lethal dose would be greater. The facts cited should enlist the attention of the Committee on the Revision of the Pharmacopœia, with a view to the adoption of the strength-percentage recognized by the Brussels convention.—Editorial in *Amer. Med.*, 1902, p. 721.

PHARMACEUTICAL MEETING.

The regular monthly pharmaceutical meeting of the Philadelphia College of Pharmacy was held on Tuesday, November 18th, Mr. Warren H. Poley, President of the Philadelphia Association of Retail Druggists, acting as chairman.

Mr. M. I. Wilbert was the first speaker and read a paper on "Some New Soap Preparations," samples of which he exhibited.

(See page 587.)

In reply to a question as to the advisability of dispensing the soap preparation containing benzin, Mr. Wilbert and Mr. Poley both said that it was customary to use a special caution label in such cases. Mr. Poley also said that the city authorities are taking steps in regard to the storing of benzin in drug stores. Dr. Lowe said that the insurance companies limit the amount to five gallons, and Mr. Kebler said that they would not even permit a large firm to keep a plumber's lamp containing benzin. In regard to the shades of soap, Mr. Kebler said that these depended upon the kind of vessel in which the soap was made—that made in a copper vessel being comparatively dark, and that made in an iron kettle still darker. He said that the light product was looked upon as impure, while in reality it is the purest, it being made in a porcelain vessel. Mr. Kebler also remarked that he had found phenolphtalein unsatisfactory for determining the alkalinity of soap.

Mr. William B. Marshall read an interesting paper entitled "Tea: Its History and Commerce," and exhibited a number of photographs, samples, etc., in connection therewith.

In reply to a question by E. M. Boring in regard to tea-growing in the United States, Mr. Marshall said that it had been very successful in South Carolina, and further said that it has been found that a number of plants and some animals do better in other countries than in their native countries, and he hoped that since the Agricultural Department had taken up the subject, tea would become an article of agriculture here. Dr. Henry Leffmann referred to a recent article in the *New York Medical Record*, in which the writer recommended the use of tea as a remedy for cholera in the Philippine Islands, owing to the bad quality of the water there. He claimed that the Chinese are comparatively free from cholera, and attributed this to their custom of tea-drinking, the otherwise bad water being boiled and thus disinfected. In response to a question by Mrs. Julia Davis Chandler, Mr. Marshall said that in some parts of Japan the flowers of certain plants, as of camelia and olive, are used for perfuming teas.

Mr. Harry Matusow spoke of the method used by the Russians in making the infusion of tea. A very strong infusion is first made and then a small quantity of this is diluted with hot water.

Mr. Marshall further remarked that the price paid for tea in this country is not regulated by the price in foreign countries, but that

it is based upon the quality as determined by the tea-tasters in this country. The tea-tasters become quite expert and the prices as set by them are quite uniform for the same grades of tea. Mr. Kebler said some experts could tell oil of wintergreen from methyl salicylate, while a chemist could not do this from analytical figures. Mr. Boring said that he recently rejected a lot of beeswax on appearance alone, which he subsequently ascertained contained about 80 per cent. of paraffin.

Professor C. B. Lowe was the next speaker, and described some of the detail methods which he employs in the conduct of his store.

In the discussion that followed, Mr. Poley recommended the use of a sailor's needle for removing corks, and said that the convex side should be placed next to the cork. Mr. Matusow said that a dentist's instrument is also useful for this purpose, and Mr. Leedom said that he found a shoemaker's awl useful.

In regard to the filtering of solutions to be dispensed, Professor Remington said that it was a mistake to use filter paper at all times; it took frequently considerable time to do this, and a small strainer answered the purpose better in many instances. Mr. Leedom suggested that simply filtering through cotton was convenient; and Mr. Wilbert and Mr. Boring both stated that foreign objects, such as pieces of cork, might be removed from solutions by the use of a toothpick.

Mr. Poley said that in the dispensing of solutions for the eye, the patient should be cautioned against the use of droppers that had previously been used. Mr. Boring exhibited a large bottle which had contained collodion solution of salicylic acid and upon the sides of which the salicylic acid had beautifully crystallized out.

Mr. Lyman F. Kebler read a paper on the "Distribution of Arsenic."

In the discussion of this paper, Dr. Leffmann said that it illustrated the saying that everything exists in everything. He said that Professor Crookes had found yttrium, one of the rare metals, widely distributed, although in small quantities. Referring to the presence of arsenic in chemicals, he said that since its interference in the new contact method for the manufacture of sulphuric acid had been eliminated, we would be relieved of the danger of arsenic from iron pyrites. He also said that perfect purity practically does not exist.

H. K.

INDEX

TO VOLUME 74 OF THE AMERICAN JOURNAL OF PHARMACY.[1]

SUBJECTS.

Acacia, adulteration 23
(Wood) 201
Acetone sulphite 441
Acetozone 441
Acid, acetyl salicylic 442
cacodylic 88
carbolic 91, 293
chromic, adulteration 18
glycerino arsenic 293
glycerophosphoric and glycerophosphates 498
glyconic 295
hydrocyanic 91
oleic 92
picric 92
prussic in cassava 46
sulphuric, aromatic 570
the new contact method for the manufacture (Sadtler) 285
tannic, adulteration 14
uric, the oxidation and determination of, and urates 571
Acoin 603
Aconite root, adulteration 20
Adlumia cirrhosa, alkaloids of 502
Adrenalin 88
Adulteration of drugs and food products (Robin) 177
of drugs (Kebler) 12, 138
in England 34
recent (Kebler) 138
Agitation, mechanical 511
Agurin 88
Alcohol, methyl 92
source of motive power 441
Alkaloidal stability of certain standard preparations of the British Pharmacopœia 569
Alkaloids, method of determining the solubility (Hatcher) 134
Aloin-red, and guaiac-blue, and their uses for chemical reactions 491
Aloes, adulteration 24
chemistry 442
Ammonium acetate, adulteration 13
Amyl salicylate 293
Analysis, gasometric (Moerk) 389
Analysis, organic qualitative 512
Anesthesin 442
Antidecubin 601
Antithyreoidin 601
Antitoxin, diphtheria, and the outbreak of tetanus in St. Louis 41
free distribution by boards of health 513

[1] Compiled by F. Yaple.

Apomorphine 90
Argon group, history of 605
Apprentice of former days, the (McIntyre) 532, 574
Arrhenal 293
Arsenic in chemicals 496
organic combinations 293
test, modification of Bettendorf's test 297
Asafetida, adulteration 24
adulterated (La Wall) 395
Aspirin 442
Assay of granatum bark 357
moist opium and tinctures of opium 501
pharmacological (Cushny) 1
of cannabis indica 570
of digitalis and kindred drugs 500
Association, American Pharmaceutical 305, 484
adresses at the Jubilee Session 461
banquet 524
historical exhibition (Wilbert) 536, 575
Pennsylvania Pharmaceutical 405
Associations, origin, history and influence of State Pharmaceutical Associations (Lemberger) 7
Atomic theory 46
weights, the basis of (Smith) 153
weight tables, comparative study (Wilbert) 231
Atoxyl 293
Atropine, action of 503

Bacilli, typhoid, identification of 147
Bark, powdered elm, adulteration 21
Bay rum 601
Beeswax, adulteration 19, 142
Benefactor, a true (Thompson) 137
Berberine, estimation of (Gordin) 37
presence of, in Stylophorum diphyllum and Chleidonium majus . . . 585
Biogen 443
Bismuth citrate and liquor bismuthi 572
salts in mixtures 572
Bismutose 602
Blood examination as an aid to the general practitioner (Simmons) . . . 347
new method for distinguishing human from that of animals 298
Blue, soluble, adulteration 14
Board of Pharmacy Examinations and college diplomas 514
a plea for a national 515
Botanical nomenclature (Lloyd) 303
Bromocoll 88
Bromo-farina 296
-pan 296

Caffeine 90
estimation of 600
Calcium iodate 91
phosphate, precipitated, adulteration 13
Cannabis indica, chemistry 448, 482
collection, composition, etc. 570
physiological tests 570
Capsicum, adulteration 20
Capsules, a method for filling with essential oils (Toplis) 36
Cascara preparations, tasteless 571
Century plants, useful products of (Marshall) 323

Certificate, legend on college (Wiegand) 453
Chamois skins (Drueding) 224, 242
Chelidonium majus, color compound 502
majus and Stylophorum diphyllum, color-compound (Schlotterbeck) . 584
Chelidoxanthin, identity with berberine 584
Chemists honored, American 208
Chibu, specimen of (Gane) 52
Chloretone 89
Cinchona bark, Van Ketel's researches on alkaloidal contents (Nagelvoort) 25
Cinchonine, the solubility of (Hatcher) 136
Cinnamon bark, artificial 139
Clothes cleaner, formula for 589
Cochineal, adulteration 21
Coffee and tea as precipitants for poisons 299
its history and commerce (Marshall) 361
College course, pharmaceutical testing as a part of the 516
entrance requirements, a plea for higher 515
Colleges of pharmacy, Æsop's advice to 515
entrance and graduate requirements 518
Colloids, the effect of, in diminishing the toxicity of strychnine (Hatcher) 283
Colognes and toilet waters (Scoville) 559
Commercialism and medicine 207
Contusions and wounds, the treatment of, by the apothecary (Lowe) . . 386
Copper, the presence of, in powdered drugs and chemicals (Gane) 289
Coriariæ, toxic principles of 572
Coumarin, adulteration 14
Creosote, nomenclature 496
Crurin 294
Cystogen 90

Derris uliginosa, anatomy of the stem 492
chemistry of the stem 491
Digitalis, relative strengths of various preparations of, and kindred drugs, as shown by experiments with frogs 500
Dionin 603
Diosmal 602
Diphtheria antitoxin and the outbreak of tetanus in St. Louis 41
Dispensing by physicians 514
Dose measures and measured doses (Wilbert) 120
drops as (Wilbert) 375
standardizing 495
Doses, definition for and equivalents of spoonful (Wilbert) 218
Drops as dose measures (Wilbert) 375
Drug and medicinal-plant investigation in the U. S. Department of Agriculture (True) 419
Drug-habit, report of Committee of A.Ph.A. on acquirement of the (Hynson, chairman) 547
Drugs, cheap (Kraemer) 311
The U. S. Pharmacopœia descriptions of crude (Wilbert) 271

Elm bark, powdered, adulteration 21
Enzymes, nature of 352
Ergot, active principle of 503
adulteration 141
Eucaine, identification and properties of α- and β- (Parsons) 194, 236
Extraction apparatus for the exhaustion of watery liquids by immiscible volatile solvents (Sollmann) 279
Extract of ergot 447
fluid, nux vomica (Sieker) 175
Extracts, alcoholic 573

EDITORIAL NOTES AND COMMENTS:
American Pharmaceutical Association 305, 358, 399
atomic theory 46
chemistry of ions 149
fertilization 46
German Pharmacopœia 45
Pennsylvania Hospital 149
Prussic acid in cassava 46
Rice, memorial to Dr. Charles 148, 306
Rice's grave, to mark Dr. Charles 44
tuberculosis, human and bovine 150

Ferments, the evolution and use of the animal digestive, in medicine (Fairchild) 53, 101, 105
Ferric cacodylate 293
Ferrichthyol 295
Fertilization 46
Fire-proofing treatment of wood (Sadtler) 590
Flaxseed, ground, adulterated with mineral oil (Kebler) 39
Formaldehyde 91, 294
color reactions of certain coal-tar derivatives and morphine with, (Hatcher) 35
Formin 90

Glycerinum bismuthi carbonatis 572
Glycerino arsenic acid 293
Ginger, cultivation 292
Gluton 294
Glycosal 295
Gordin, H. M. Personal note 360
Granatum, assay of 357
Guaiac-blue and aloin-red and their use for chemical reactions 491
Guaiacol cacodylate-cacodiacol 293
Guaiacum, medicinal properties 443
Gum acacia, adulteration 23
tragacanth, adulteration 23

Hellebore 602
Hematin product, preparation (Sollmann) 275
Hetol 89
Hexamethylene tetramine 90
Honey, adulterated 140
Honthin 89
Horse-chestnuts 91
food value of 600
Hospital, Pennsylvania 149
Hydrogen dioxide 443
peroxide (Pursel) 424
Hyoscyamine, action of 503
Hyoscyamus muticus (Nagelvoort) 418

Ichthyoform 89
Ichthyol 295
Igazol 89
Infant-feeding, artificial 299
International conference for the unification of potent drugs, etc. 597
Iodine from seaweeds 292
Ions, chemistry 149
Ipecac root 91
Isarol 603

Jaborandi, adulteration 21

Kino, adulteration 24
Koryzaphylla 443

Lactucarium, adulteration 22
Lantern slides 516
Law, Maryland pharmacy 339
poison, Ohio 336
Laws regulating the sale of poisons (Lemberger) 428
uniform pharmacy 515
Lead salts, volumetric estimation 573
Leaves, jaborandi, adulteration 21
Lecithol 603
Leech hirudo or sanguisuga (Lemberger) 422

Legislation and judicial decisions of interest to pharmacists for the year 1901–1902 (Beal) 336
commercial value of pharmaceutical 521
Liquor bismuthi and bismuth citrate 572
bromo-chloral compositus, B.P.C. 573
krameriæ concentratus, B.P. 572
thyroidei 571
Lithium salolo-phosphoricum 295
Lychnis flos cuculi, saponin of 600
Lysoform, formula 587

Magnesium cacodylate 293
dioxide 443
Marsyle 293
Maryland pharmacy law 339
Martindale, William, a biographical sketch (Gane) 397
Materia medica, laboratory teaching 518
Mechanical agitation 511
Medicine and commercialism 207
Menthol solution, saponaceous 590
Mesotan 603
Metric system in the United States 206
in English-speaking countries (Wilbert) 411
Microcidin 444
Milk analysis, new apparatus for 572
certified 452
examination of 497
product industry, the American 494
Mixtures, refraction of (Stevens) 577
Morphine (Ebert) 169
color-reactions of certain coal-tar derivatives and morphine with formaldehyde and sulphuric acid (Hatcher) 35

Narcotics and the habitues 517
Narcotine (Ebert) 157
pharmacology of 507
Neo-arsycodyle 293
New remedies, number of 441
of 1901 . . . . . 93, 148
Nomenclature, botanical (Lloyd) 303
Nurses, licenses for 207
Nux vomica, fluid extract (Sieker) 175

OBITUARY:
Maisch, Henry C. C. . . . 458
Martindale, Thomas (Gane) . . . 397
Mohr, Charles . . . 459
Scheffer, Emil (Diehl) . . . 209
Warrington, Charles W. . . . 458
Oleates, preparation in powder form . . . 437, 480
Oleo-palmitates, preparation in powder form . . . 437, 480
stearates, preparation in powder form . . . 437, 480
Ohio poison law . . . 336
Opium, adulteration . . . 444
assay of moist . . . 501
deodorized and tincture, the manufacture (Ebert) . . . 157
Oil of begamot, adulteration . . . 16, 139
camphorated . . . 573
cassia, adulteration . . . 16
cloves . . . 497
cloves, estimation of phenols . . . 143
cod-liver, pancreatized . . . 603
copaiba, adulteration . . . 16
croton, detection in tincture of iodine . . . 602
croton, in tincture of iodine . . . 139
neroli, Chinese . . . 570
olive, commercial varieties and pharmacopœial tests . . . 570
pepermint, adulteration . . . 17
phosphorated . . . 92
sweet almonds, expressed, and its subtitutes . . . 495
thyme—white, adulteration . . . 17
walnuts, adulteration . . . 18
wine—heavy and light, adulteration . . . 18
wintergreen and its adulterants . . . 498
wormwood, adulteration . . . 142
Oils, some curious . . . 495
Opium, Persian . . . 600

Pancreatized cod-liver oil . . . 603
Petrolatum, oxygenated . . . 589
Pancreone . . . 444
Paprika, adulteration . . . 20
Pepper, imitation . . . 141
Pepsin, nature of . . . 450
Petrox, formula for . . . 589
iodine . . . 589
Pharmaceutical Conference, British (proceedings) . . . 568
Pharmaceutical manufactures, the advances made in, during the past fifty years (Schieffelin) . . . 464
Pharmaceutical Society of Japan, the . . . 601
Pharmacist, education of . . . 571
Pharmacopœias . . . 290
British . . . 85
German . . . 45, 86
German Hospital of the City of Philadelphia . . . 456
Homeopathic . . . 86
Italian . . . 206
Swedish . . . 86, 439
Swiss . . . 86
Universal . . . 87, 439
U. S. (Digest of Criticisms) . . . 241
U. S., Evolution of (Wilbert) . . . 261

U. S., on the recognition of synthetic chemicals in the coming edition of the (Wilbert) . . . 554
Should pharmacists always follow out the rules laid down in the (Remington) . . . 384
Pharmacy during fifty years, status and landmarks of American Pharmacy and the development of (Lemberger) . . . 470
in America, prehistoric (Lloyd) . . . 543
laws, uniform . . . 515
progress in (Wilbert) . . . 82, 290, 439
the father of American (Ebert) . . . 461
Phenolphtalein . . . 295
Phenols, estimation . . . 143
Phenosalyl . . . 604

PHILADELPHIA COLLEGE OF PHARMACY:
Alumni Association (annual meeting) . . . 249
annual meeting (minutes) . . . 258
certificate, legend in college (Wiegand) . . . 453
commencement exercises . . . 244
examination questions . . . 249
graduates . . . 244
members—honorary elected . . . 260
minutes of the meetings . . . 104, 258, 409, 576
officers and trustees elected . . . 260, 410, 576
Pharmaceutical meetings . . . 49, 101, 153, 201, 241, 308, 574, 610
Specimens presented and exhibited . . . 52, 103, 310, 575, 610
Prizes . . . 247
Reports of officers and standing committees . . . 258, 260, 410
Reunion of graduates . . . 526
Supper of the Faculty . . . 248
Pill, the sugar coated (Warner) . . . 32
Pills, sugar coated (Wiegand) . . . 33
Podophyllin, examination of . . . 494
powdered, adulteration . . . 14
Poisons, coffee and tea as precipitants for . . . 299
Poison law, Ohio . . . 336
laws regulating the sale of (Lemberger) . . . 428
Potent drugs, International conference for the unification of . . . 597, 609
Powders in prescription work, a method of dividing (Weills) . . . 425
Prescott, A. B., a portrait of . . . 208
presentation of portrait of, to the University of Michigan . . . 335
Procter, William, Jr., the father of American pharmacy (Ebert) . . . 461
Progress in pharmacy—a quarterly review (Wilbert) . . . 82, 290, 439, 597
Proprietary medicines, use and abuse of . . . 516
Pulmin . . . 445
Pulmoform . . . 444
Purgatin . . . 89
Pyridin tannate . . . 604

Quarterly review of progress in pharmacy (Wilbert) . . . 82, 290, 439, 597
Quinine . . . 92
as an antiseptic . . . 445
for hypodermic use . . . 296

Refraction of mixtures (Stevens) . . . 577

REVIEWS AND BIBLIOGRAPHICAL NOTICES:
Bailey, E. H. S. and Hamilton P. Cady. A laboratory guide to the study of qualitative analysis . . . 240

REVIEWS AND BIBLIOGRAPHICAL NOTICES—(Continued.):
Cady, Hamilton P. and E. H. S. Bailey. A laboratory guide to the study of qualitative analysis . . . 240
Coblentz, Virgil. Manual of volumetric analysis . . . 48
Cohn, Alfred I. Indicators and test-papers . . . 239
Crinon, C. Revue des Medicaments Nouveaux et de Quelques Medications Nouvelles . . . 307
Digest of criticisms on the U. S. Pharmacopœia . . . 241
Fox, George Henry. Treatise on smallpox . . . 153
Gérard, E. Precis de Manipulations de Pharmacie . . . 567
Hatcher, Robert A. A laboratory manual of urinary analysis . . . 307
Humphrey, John, and Edmund White. Pharmacopœdia . . . 47
Lloyd, J. U. and C. G. Bulletin of the Lloyd library of botany, pharmacy and materia medica, references to capillarity . . . 455
Morgan, J. Livingston. The elements of physical chemistry . . . 238
Pharmacopœia of the German Hospital of the city of Philadelphia . 456
Practical methods of urine analysis for chemists and druggists . . . 457
Prescott, A. B., and Eugene C. Sullivan. First book of qualitative chemistry . . . 454
Proceedings of the American Pharmaceutical Association . . . 238
Rockwood, Elbert W. An introduction to chemical analysis . . . 49
Sullivan, E. C., and A. B. Prescott, First book of qualitative chemistry . . . 49
White, Edmund, and John Humphrey. Pharmacopœdia . . . 47
Wiesner, Julius. Die Rohstoffe des Pflanzenreiches . . . 240
Rheumatin . . . 445
Rhubarb, active principles . . . 445
Rice's grave, to mark Charles . . . 44
Rice, Charles, memorial to . . . 148
Ruhl, H. F. Tincture of arnica flowers . . . 427

Sadtler, S. P. Personal note . . . 360
Salicin in different willow and poplar barks . . . 573
Salicylates . . . 92
aluminum . . . 92
ammonium . . . 92
copper . . . 92
iron . . . 92
Salinigrin in different willow and poplar barks . . . 573
Salochinin . . . 445
Salvosal-lithium . . . 295
Sander, Enno, a banquet to . . . 208
Sapoform, formula . . . 588
carbolic acid . . . 588
Saponin of Lychnis flos cuculi . . . 600
Scheffer, Emil. Biographical sketch (Diehl) . . . 209
(Thompson) . . . 137
Scopolamin and scopolin . . . 491
Seidlitz powders (French) . . . 74
Senna, chemistry . . . 93
commerce (Wood) . . . 201
Separator holder . . . 511
Serum, antidiphtheria, the official recognition of . . . 572
bromatum . . . 297
iodatum . . . 297
scarlet-fever . . . 601
thyreoid . . . 601
Shaving paste, aseptic surgical . . . 571
Silver, organic salts . . . 90

Soaps for surgical and toilet purposes, liquid (Wilbert) 172
Soap preparations, new (Wilbert) 587
Sodium arsenate, volumetric determination 573
bisulphate 296
carbonate 445
in sodium sulphate, determination 500
naphtolate 444
persulphate 296
phosphate, tri-basic (Eigelberner) 596
phosphate, volumetric determination 573
Solanum dulcamara, active principles 573
Solution of magnesium citrate, sterilization of (Watson) 345
Soxhlet apparatus, a way of restoring, to usefulness (Sollmann) 281
Specific gravity (Wiegand) 230
Spoonful doses, definition for and equivalents (Wilbert) 218
Starches, commercial, new methods for the microscopical examination . . 496
State Pharmaceutical Associations, origin, history and influence (Lemberger) 7
Stannous chloride, solubility in ethylic ether 297
Strophanthus 93
Strychnine, the effect of colloids in diminishing the toxicity of (Hatcher) . 283
the quantitative estimation of, in mixtures of strychnine and brucine, 492
Strychnicin 604
Stylophorum diphyllum, color-compound (Schlotterbeck) 502, 584
Sucramine 446
Sugar, tests for 446
Sugar of milk 292
the American industry 494
Suppository mold (Chapman) 520
Synthetic chemicals, on the recognition in the coming edition of the U. S. Pharmacopœia (Wilbert) 554
Syrup, rock-candy, adulteration 22

Tablets, compressed 571
solubility of compressed (Hance) 80
Tannin 446
Tea and coffee as precipitants for poisons 299
Tetanus, outbreak in St. Louis 41
Thebaine hydrochlorate 296
Therapeutic application of X-rays (Wilbert) 579
Thesis, the writing of a (Dohme) 527
Thigenol 295
Tincture of aconite 493
arnica flowers (Ruhl) 427
iodine 446
iodine, oil of croton in 139
opium, assay of moist opium and 501
opium deodorized, manufacture (Ebert) 157
standardized, and ipecacuanha wine of the B.P. 569
Tinctures, alcoholic, changes in 600
Tobacco, alkaloids of 292
Toilet waters and colognes (Scoville) 559
Tragacanth, adulteration 23
Tuberculosis, spread of, by coughing (Boston) 169, 202
Turpentine, Venice, adulteration 22

Upol 446
Urates, the oxidation and determination of uric acid and 571
Uresin 90

Urine, examination of the albuminous constituents 145
Urol 90
Urotropin 90

Vaccine virus, free distribution by boards of health 513
Valuation of cortex granati 357
Valyl 446
Vanilla, adulterated 141
Vanillin, adulteration 15
Van Ketel's researches on alkaloidal contents of cinchona bark (Nagelvoort) 25
Vegetable drugs, some factors influencing the quality of (Kraemer) . . . 311
Volumetric solutions, limits of reliability 573
Wall paper, comparative stability of colors in 499

Water, filtration of drinking (Toplis) 67
organized as a food 499
Waters, aromatic, as a cause of precipitation 520
toilet and colognes (Scoville) 559
Wax, adulteration 446
Japan, adulteration 20
Wines 93
ipecacuanha and standardized tinctures of the B.P. 569
Wood, fire-proofing of (Sadtler) 590

X-rays, therapeutic application of (Wilbert) 579

Yohimbin 600

AUTHORS.

Beal, J. H. Legislation and judicial decisions of interest to pharmacists for the year 1901–1902 336
Beringer, George M. An ode to the founders of the American Pharmaceutical Association 479
Boston, L. Napoleon. The spread of tuberculosis by coughing 169

Cushny, Arthur R. Pharmacological assay of drugs 1

Diehl, C. Lewis. Emil Scheffer, a biographical sketch 209
Dohme, A. R. L. The writing of a thesis 527
Drueding, Charles C. Chamois skins 224

Ebert, Albert E. On the manufacture of deodorized opium and tincture, 157
The father of American pharmacy 461
Eigelberner, H. B. Tri-basic sodium phosphate 596

Fairchild, Benjamin T. The evolution and use of the animal digestive ferments in medicine 53, 101, 105
French, Rolland H. Seidlitz powders 74

Gane, E. H. The presence of copper in powdered drugs and chemicals . 289
Specimen of chibu 52
William Martindale 397
Gordin, H. M. Note on the estimation of berberine 37

Hance, Anthony M. Solubility of compressed tablets 80
Hatcher, Robert A. Color reactions of certain coal-tar derivatives and morphine with formaldehyde and sulphuric acid 35
The effect of colloids in diminishing the toxicity of strychnine . . . 283
Method of determining the solubility of alkaloids 134
The solubility of cinchonine 136
Hynson, H. P. Report of committee on the acquirement of the drug habit, 547

Kebler, Lyman F. Adulteration of drugs 12
Ground flaxseed adulterated with mineral oil 39
Kraemer, Henry. Cheap drugs, or some of the factors influencing the quality of vegetable drugs 311

LaWall, Charles H. Adulterated asafetida 395
Lemberger, Joseph L. Laws regulating the sale of poisons 428
The leech hirudo or sanguisuga 422
Origin, history and influence of State pharmaceutical associations . . 7
Status and landmarks of American pharmacy and the development of pharmacy during fifty years 470
Lloyd, C. G. Botanical nomenclature 303
Lloyd, John Uri. Our centennial 476
Prehistoric pharmacy in America 543
Lowe, Clement B. The treatment of contusions and wounds by the apothecary 386

Marshall, William B. Coffee: Its history and commerce 361
Useful products of the century plants 323
McIntyre, William. The apprentice of former days 532
Moerk, Frank X. Gasometric analysis 389

Nagelvoort, J. B. Hyoscyamus muticus 418
Van Ketel's researches on alkaloidal contents of cinchona bark . . . 25
Niece, Frederic E. The preparation of oleates, oleo-palmitates and oleo-stearates in powder form 437, 480

Parsons, Charles Lathrop. Identification and properties of α- and β-eucaine 194, 236
Pursel, Robert C. Hydrogen peroxide 424

Remington, Joseph P. Should pharmacists always follow out the rules laid down in the pharmacopœia 384
Robin, Albert. Adulteration of drugs and food products 177

Sadtler, Samuel P. Advances in the fire-proofing of wood. The new contact method for the manufacture of sulphuric acid 285
Schieffelin, William Jay. The advances made in pharmaceutical manufactures during the past fifty years 464
Schlotterbeck, J. O. Color-compound of Stylophorum diphyllum and Chelidonium majus 584
Scoville, Wilbur L. Colognes and toilet waters 559
Sieker, Ferdinand A. Fluid extract of nux vomica 175
Simmous, Warren S. Blood examination as an aid to the general practitioner 347
Smith, Edgar F. The basis of atomic weights 153
Sollman, Torald. A practical method of preparing a hematin product . . 275
A way of restoring broken soxhlet apparatus to usefulness 281
Extraction apparatus for the exhaustion of watery liquids by immiscible volatile solvents 279
Stevens, James S. Indices of refraction of mixtures 577

Thompson, Wm. B. A true benefactor (Prof. Emil Scheffer) 137
Toplis, William G. A method for filling capsules with essential oils . . . 36
Filtration of drinking water 67
True, Rodney H. Drug and medicinal plant investigation in the U. S. Department of Agriculture 419

Warner, Jr., William R. The sugar-coated pill 32
Watson, Herbert J. Sterilization of solution of magnesium citrate . . . 345

Weills, Isaac M. A method of dividing powders in prescription work . . 425
Wiegand, Thomas S. Legend on college certificate 453
Notes on specific gravity 230
Sugar-coated pills 33
Wilbert, M. I. After-thoughts of the Historical Exhibition of the American Pharmaceutical Association 536
Comparative study of atomic weight tables 231
Dose measures and measured doses 120
Drops as dose measures 375
Evolution of the U. S. Pharmacopœia 261
Liquid soaps for surgical and toilet purposes 172
The metric system of weights and measures in English-speaking countries 411
Quarterly review of progress in pharmacy 82, 290, 439, 597
On the recognition of synthetic chemicals in the coming edition of the U. S. Pharmacopœia 554
Some new soap preparations 587
Spoonful doses, definition and equivalents 218
Therapeutic application of X-rays 579
The U. S. Pharmacopœia descriptions of crude drugs 271
Wood, H. C. Acacia 201
Senna 201

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CONTENTS.

The Indices of Refraction of Mixtures. By James S. Stevens 577

The Therapeutic Application of the X-rays. By M. I. Wilbert 579

The Color-Compound of Stylophorum Diphyllum and Chelidonium Majus. By J. O. Schlotterbeck 584

Some New Preparations Containing Soap. By M. I. Wilbert 587

On Some Recent Advances in the Fire-proofing Treatment of Wood. By Samuel P. Sadtler 590

Tri-Basic Sodium Phosphate. By H. B. Eigelberner 596

Progress in Pharmacy—A Quarterly Review. By M. I. Wilbert 597

Recent Literature Relating to Pharmacy: History of the Members of the Argon Group; International Standard of Potent Remedies 605

Pharmaceutical Meeting 610

Index 613

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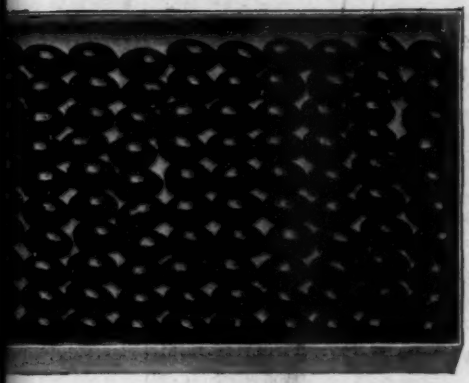

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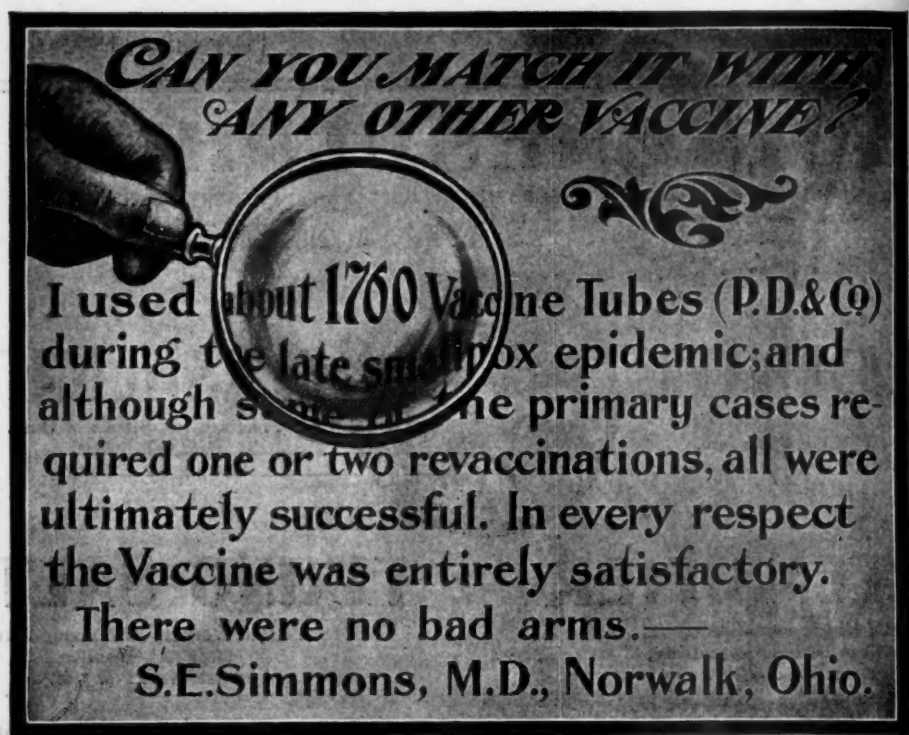
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